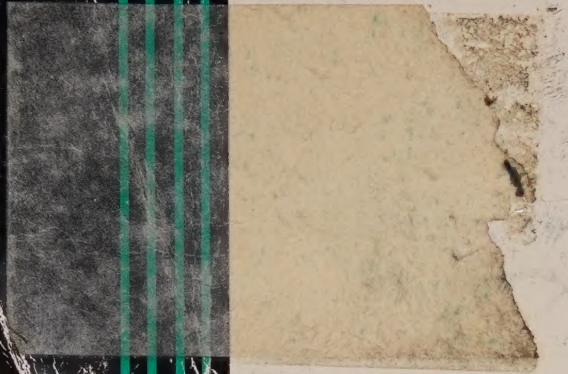
USER'S GUIDE



INTERCEPTOR™ 1402

Communications Analyzer

Telecommunications Techniques Corporation®

A DYNATECH COMPANY

. . . EXPECT EXCELLENCE

ML# 11661
Rev. B

USER'S GUIDE

INTERCEPTOR™ 1402

Communications Analyzer

July, 1992

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INTRODUCTION
INTERCEPTOR 1402 USER'S GUIDE

The *INTERCEPTOR 1402 User's Guide* provides an easy method of locating important applications for the INTERCEPTOR 1402. This guide is designed to present the most frequently used elements of testing and test set-ups in complete and concise steps. Illustrations, helpful notes, and step-by-step procedures make this guide a unique reference tool for both new and experienced users.

Use this guide cover-to-cover, or as a reference for specific information. This guide provides an overview of how the INTERCEPTOR 1402 can be used to test and/or monitor circuits in a variety of network and equipment configurations. Please refer to the *INTERCEPTOR 1402 Reference Manual* for more information about the INTERCEPTOR 1402.

The following features described in this guide will help you save time and help you use the INTERCEPTOR 1402 to your best advantage.

- **PERFORMING A TEST WITH THE INTERCEPTOR 1402:** This section describes the basic steps in performing a test with the INTERCEPTOR 1402. Special emphasis is given to the parts of the unit that are most often used during testing. The order of this section is as follows:

- Selecting the TEST MODE
- Configuring the INTERCEPTOR 1402
- Confirming the test set-up
- Cabling the INTERCEPTOR 1402
- Running the test
- Analyzing signal status
- Collecting test results
- Error insertion
- Printing test results

- **APPLICATIONS/SET-UP PROCEDURES:** This section shows how to use the INTERCEPTOR 1402 in a variety of common test scenarios. Test scenarios and instrument set-ups are provided for:

  - In-service analysis
  - Point-to-point testing
  - Testing two multiplexers
  - Testing two demultiplexers
  - Printer configuration

- **AUXILIARY FUNCTIONS:** This section contains a list and description of the auxiliary functions.
- **GLOSSARY:** If you are unfamiliar with the meaning of an Analysis Result, refer to the Glossary for clarification.
- **INDEX:** A quick reference, to help you find which pages contain the procedures you need.

You may want to review PERFORMING A TEST before beginning an APPLICATION or you may want to start an APPLICATION and then refer back to PERFORMING A TEST.

SECTION 1
PERFORMING A TEST WITH THE INTERCEPTOR 1402

1.1 INTRODUCING THE INTERCEPTOR 1402

The INTERCEPTOR 1402 is a versatile test set that can test at dedicated 2, 8, 34, or 140 Mb/s rates; and simulate a multiplexer/demultiplexer to receive, analyze, and transmit data at different rates. With each test you can obtain a variety of key measurements including: bit errors, code errors, frame alignment signal (FAS) errors, signal analysis, and either G.821 or M.550 performance analysis.

1.2 BASIC STEPS IN INTERCEPTOR 1402 TESTING

Performing a test with the INTERCEPTOR 1402 involves these basic steps:

1. Selecting the TEST MODE.
2. Configuring the INTERCEPTOR 1402.
3. Confirming the test set-up.

4. Connecting the INTERCEPTOR 1402.
5. Running the test.
6. Analyzing signal status.
7. Collecting test results.
8. Error insertion.
9. Printing test results.

Figure 1-1 shows the front panel of the INTERCEPTOR 1402. The numbers for each item in the figure correspond to the front-panel component that controls each basic step.

NOTE: This section only describes the parts of the INTERCEPTOR 1402 front panel that are essential to test set-up and analysis. Refer to Section 2 of the *INTERCEPTOR 1402 Reference Manual* for additional information about the instrument front panel switches.

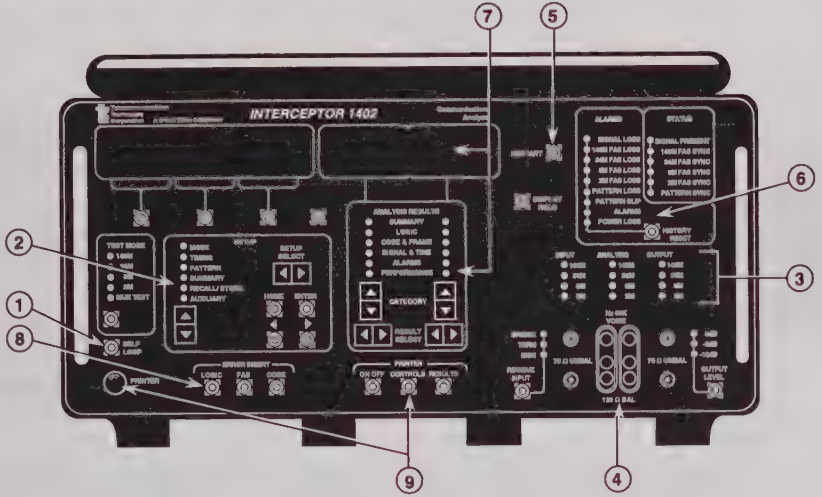

Figure 1-1
INTERCEPTOR 1402 Front Panel

1. Selecting the TEST MODE

The **TEST MODE** switch determines whether the INTERCEPTOR functions as a dedicated test instrument or as a multi-rate test instrument with a built-in multiplexer/demultiplexer. A push button switch controls test mode selection. The currently selected test mode is indicated by the LED illuminated next to the test mode label. Pressing this push button scrolls to the next available mode selection and illuminates its LED.

2. Configuring the Test Set-up

Visually inspect the INTERCEPTOR 1402 front panel display and indicators to verify the unit has been properly set for the test to be performed. The SETUP panel and display section determine the operating configuration for the selected TEST MODE. Use the CATEGORY rocker switch to scroll through the categories (MODE, TIMING, PATTERN, SUMMARY, RECALL/RESTORE, and AUXILIARY) above this switch. The illuminated LED next to the selected category label indicates the category selected. The SETUP SELECT label is backlit when additional menus, other than the menu displayed, are available for the selected category. Press the left or right arrow on the SETUP SELECT rocker switch to scroll through the additional menus. Continually pressing the left or right arrow on the SETUP SELECT switch scrolls through the other menus available. No additional menus are available for the selected category when the SETUP SELECT label is not backlit. The INTERCEPTOR will beep if the user presses an unavailable selection.

3. Confirming the Test Set-up

The RATE indicator panel displays the current INTERCEPTOR configuration (see Figure 1-2). These indicators display the currently selected INPUT, ANALYSIS, and OUTPUT rate(s). Use these indicators to confirm the INTERCEPTOR test set-up.

Figure 1-2
RATE Indicators

4. Connecting the INTERCEPTOR 1402

Use the connectors and switches located in the lower right corner of the INTERCEPTOR front panel (see Figure 1-3) to cable the INTERCEPTOR to the circuit under test. It is important to note that the input and output connectors for the 140M mode are located on the INTERCEPTOR right side panel. The following three steps are required to cable the INTERCEPTOR:

- Set the RECEIVE INPUT.
- Set the OUTPUT LEVEL.
- Cable the INTERCEPTOR (connect to the appropriate connector).

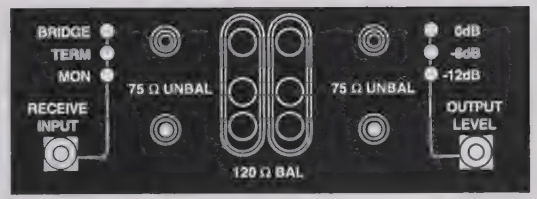

Figure 1-3
Input/Output Connectors

RECEIVE INPUT - Press the **RECEIVE INPUT** switch to select the input impedance and signal conditioning (BRIDGE, TERM, MON).

BRIDGE - Select BRIDGE to connect the INTERCEPTOR to an already correctly-terminated circuit without disrupting traffic. This selection is only valid in 2M mode, using a 120Ω connection.

TERM - Select TERM to allow the INTERCEPTOR to terminate a circuit.

MON - Select MON to connect the INTERCEPTOR to a monitor access point with 20 to 30 dB of resistive loss.

OUTPUT LEVEL - Press the **OUTPUT LEVEL** switch to select the cable loss for the selected rate (0dB, -6dB, or -12dB). The selected cable loss only affects the transmit data. With 140M selected as the output rate, only 0dB is available for the output level.

Cable the INTERCEPTOR - Select either the 75Ω or the 120Ω connector. The inputs and outputs for all rates (except the 140M rate) are on the front panel. With 140M selected, the signal is connected to the side panel connector(s).

75Ω The 75Ω connectors operate in unbalanced mode at 2M, 8M, 34M, and 140M. The BNC or 1.6mm x 5.6mm connector shield connects to ground, and the center conductor carries the signal. **Do not attach a 50Ω cable to this connector.**

120Ω The 120Ω connectors operate in balanced mode at 2M only. The connector is a 3-prong banana plug.

5. Running the Test

Once you have set up your test and cabled the INTERCEPTOR 1402 for the test you wish to run, the test starts automatically. You may also begin the test by pressing the **RESTART** switch, which automatically resets all results counters and alarms.

6. Analyzing Signal Status

Use the ALARMS and STATUS LEDs to observe the current and past signal conditions. If an alarm occurs, the ALARM LED will illuminate. To clear ALARMS that have previously occurred, press the **HISTORY RESET** switch (See Figure 1-4).

The STATUS LEDs indicate when:

- SIGNAL is PRESENT,
- FAS SYNC for each rate is present, or
- PATTERN SYNC is present.

The ALARMS LEDs indicate when:

- SIGNAL PRESENT is lost,
- FAS SYNC for each rate is lost,
- PATTERN SYNC is lost,
- ALARMS occurred, or
- POWER LOSS occurred.

7. Collecting Test Results: The ANALYSIS RESULTS Panel and Display Section

The INTERCEPTOR 1402 ANALYSIS RESULTS panel and display section selects and displays two results simultaneously. (See Figure 1-5.) There are four major parts:

- **CATEGORY** switches
- **RESULT SELECT** switches
- ANALYSIS RESULTS display
- **DISPLAY HOLD** switch

Use the left and right **CATEGORY** switches to select and display an ANALYSIS RESULTS category. The left and right **RESULT SELECT** switches are used to scroll and select the specific analysis results available in each category. The left and right ANALYSIS RESULTS displays show the currently selected test results. The left **CATEGORY** and **RESULT SELECT** switches control the left display; the right **CATEGORY** and **RESULT SELECT** switches control the right display.

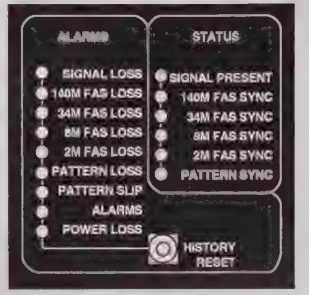

Figure 1-4
ALARM and STATUS LEDs Panel

A time-saving feature of the ANALYSIS RESULTS is the SUMMARY results category. This feature allows you to view key non-zero measurements without scrolling through the other results categories. When the SUMMARY category is selected and all summary results are error-free, the message **RESULTS OK** appears in the corresponding display; if errors are recorded, use the **CATEGORY** switch to scroll to the appropriate ANALYSIS RESULTS category (or categories) for more information.

NOTE: Both sides of the ANALYSIS RESULTS section are identical (i.e., both sides operate the same, and offer the same analysis categories and results).

The **DISPLAY HOLD** switch halts the displayed test results to the values at the time the switch was pressed. This allows individual result information to be frozen and examined without interrupting the test in progress. Pressing the **RESULTS** switch generates a results print (printing out the current result values, not the values visible in the display windows).

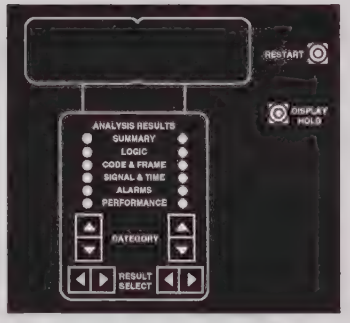

Figure 1-5
ANALYSIS RESULTS Panel and Display Section

Table 1-1 lists the test results that are available in each ANALYSIS RESULTS category. The non-zero results that are recorded in the SUMMARY category are included.

NOTE: The test measurements that are actually available will vary with the TEST MODE selected and the test performed.

Table 1-1
Analysis Categories and Results

Use This CATEGORY Switch:	To View this Result:
SUMMARY	Bit Errs (Bit Errors)* Code Err (Code Errors)* FAS Err (Frame Alignment Signal Errors)* Pat Slip (Pattern Slip)* Syn Loss (Pattern Sync Loss)* Active or History ALARMS PPM measurements (when outside CCITT specification) Power Losses*
* Only displayed when value is non-zero.	

Use This CATEGORY Switch:	To View this Result:
LOGIC	Bit Errs (Bit Errors) BER (Bit Error Rate) CRC Pat Slip (Pattern Slips) Syn Loss (Pattern Sync Loss) Slip Sec (Pattern Slip Seconds)
CODE & FRAME	Code Err (Code Errors)* CER (Code Error Rate)* CRC Err (CRC Error) CRC E RT (CRC Error Rate)

Table 1-1
Analysis Categories and Results (Continued)

Use This CATEGORY Switch:	To View this Result:
CODE & FRAME (Continued)	1Sec CRC (One-Second CRC Error) FAS Loss (FAS Sync Loss)* FAS Wd (Frame Alignment Signal Word)* NFAS Wd (Not Frame Alignment Signal) FAS Err (Frame Alignment Signal Error)* FER (Frame Alignment Signal Error Rate)* MFAS Err (Multiframe Alignment Signal Error) MFER (Multiframe Error Rate) MFAS Wd (Multiframe Alignment Signal Word)
* Results are prefixed with the appropriate rate.	

Use This CATEGORY Switch:	To View this Result:
SIGNAL & TIME	Time (Time) Date (Date) Tx Freq (Transmit Frequency per Rate)* Rx Freq (Receiver Frequency per Rate)* Rx Δppm (Receiver Frequency Deviation in ppm)* Test Sec (Test Seconds) Elap Sec (Elapsed Seconds)
* Results are prefixed with the appropriate rate.	
ALARMS	AIS (Alarm Indication Signal)* FAS Dis (Frame Alignment Signal Distant)

Table 1-1
Analysis Categories and Results (Continued)

Use This CATEGORY Switch:	To View this Result:
ALARMS (Continued)	MFAS Dis (Multiframe Alignment Signal Distant) MFAS Sync Loss Remote* PWR Loss (Power Loss count)
* Results are prefixed with the appropriate rate.	
PERFORMANCE	Avl Sec (Available Seconds)† Una Sec (Unavailable Seconds)† %Avl Sec (% Available Seconds)† ES (Errored Seconds)*† EFS (Error-Free Seconds)*† %EFS (% Error-Free Seconds)*

Use This CATEGORY Switch:	To View this Result:
PERFORMANCE (Continued)	SES (Severely Errored Seconds)* %SES (% Severely Errored Seconds)* Deg Min (Degraded Minutes) %Deg Min (% Degraded Minutes) Err-SES (Errored Seconds-Severely Errored Seconds) BER-SES (Bit Error Rate-Severely Errored Seconds) DEF S (Defect Second)*‡ Av T (Available Time)*‡ Una T (Unavailable Time)*‡ %Av T (% Available Time)*‡ MRER (Mean Residual Error Rate)*‡

Table 1-1
Analysis Categories and Results (Continued)

Use This CATEGORY Switch:	To View this Result:
PERFORMANCE (Continued)	

* Results are prefixed with the appropriate rate.
‡ Results available for M.550 only.
† Results available for G.821 only.

8. Error Insertion

Once you have begun the test, you can test the circuit using the ERROR INSERT controls. The ERROR INSERT switches enable the insertion of errors into the data stream. The switches may be used individually or in combination to insert logic, frame, and code errors simultaneously. The following paragraphs describe the three ERROR INSERT switches.

Press the **LOGIC** ERROR INSERT switch momentarily to insert a single logic error. Press the **LOGIC** switch for longer than a second to continuously insert logic errors at the rate selected in AUXILIARY CATEGORY.

NOTE: The LED in this switch illuminates when continuous error insertion is selected.

Press the **FAS** switch momentarily to insert either one, two, three, or four adjacent frame errors. The number of adjacent FAS errors inserted is selected in the AUXILIARY CATEGORY. Press the **FAS** switch for longer than a second to continuously insert the selected number of FAS errors at the rate selected in AUXILIARY CATEGORY.

NOTE: The LED in this switch illuminates when continuous error insertion is selected.

Press the **CODE** switch momentarily to insert a single code error. Press the **CODE** switch for longer than a second to continuously insert code errors at the rate selected in AUXILIARY CATEGORY.

NOTE: The LED in this switch illuminates when continuous error insertion is selected.

9. Printing Test Results: The Printer Controls

The INTERCEPTOR 1402 PRINTER controls contain three switches that are used to generate various printouts. The following paragraphs describe the PRINTER controls and front panel PRINTER connector.

Pressing the **ON/OFF** switch enables or disables the automatic print features configured in the AUXILIARY menu (status prints, timed prints, or error prints).

Pressing the **CONTROLS** switch sends the current test instrument configuration to the printer.

Pressing the **RESULTS** switch sends the current test results values to the printer.

The front panel PRINTER connector is an 8-pin, RS-232, serial port that supplies power, control, and data leads to the PR-55 lid printer.

SECTION 2
INTERCEPTOR 1402 TEST SETUPS

2.1 SECTION SUMMARY

This section shows how to use the INTERCEPTOR 1402 in a variety of common test scenarios. Test scenarios and instrument set-ups are provided for:

- In-service analysis.
- Point-to-point testing.
- Testing two multiplexers.
- Testing two demultiplexers.
- Printer configuration.

2.1.1 In-Service Analysis

Monitoring live data is the first step in fault isolation. Use the INTERCEPTOR 1402 to monitor live data at any access point along the network to obtain information on code errors, FAS errors, CRC errors, REBEs, network alarms, frequency, and to perform an in-service M.550 performance analysis. Figure 2-1 shows the INTERCEPTOR 1402 performing M.550 in-service analysis. The following procedure provides step-by-step instructions for performing in-service analysis with the INTERCEPTOR 1402.

Step:	Activity:
1.	Turn the power switch ON.
2.	If testing one rate at a time, set the **TEST MODE** switch to 2M, 8M, 34M, or 140M depending on the monitoring point.
3.	Set the **SELF LOOP** switch to OFF.
4.	Set the **SETUP CATEGORY** switch to MODE.

Step:	Activity:
5.	Using the **SETUP SELECT** switch and the softkeys below the SETUP display, configure the MODE menu as follows: **Select:** A. Set Input equal to 140M. B. Set Analysis Rate equal to Nx64. C. Set Output equal to 34M (since you are monitoring and not transmitting, this value need not be set). D. Press the ENTER key. E. Press the right half of the **SETUP SELECT** switch. F. Set 140M Coding to CMI or NRZ. If Input is other than 140M, the Coding choices are: HDB3, AMI, RZ, or NRZ. G. Press the right half of the **SETUP SELECT** switch. H. Set the all the Tx Alarms to Off. I. Press the right half of the **SETUP SELECT** switch. J. Set 140M→34M RxTrib equal to 2. K. Press the right half of the **SETUP SELECT** switch. L. Set 34M→8M RxTrib equal to 3. M. Press the right half of the **SETUP SELECT** switch.

Step:	Activity:
5. (Cont.)	N. Set 8M→2M RxTrib equal to 4. O. Press the right half of the **SETUP SELECT** switch. P. Set TS16 and CRC4 On or Off. Q. Press the right half of the **SETUP SELECT** switch. R. Set the International bit in 2M FAS to 1 or 0. S. Press the right half of the **SETUP SELECT** switch. T. Set the 2M NFAS bits to 1 or 0. Press the ENTER softkey after changing any bit value. U. Press the right half of the **SETUP SELECT** switch. V. Set the Analysis mode to Nx64. W. Press the right half of the **SETUP SELECT** switch. X. Set the Rx/Tx TS Coupling to On. Y. Press the right half of the **SETUP SELECT** switch. Z. Set the 1stTS as desired. Press the MORE softkey and set Fill to 1's. a. Press the right half of the **SETUP SELECT** switch. b. Set the 2M→8M TxTrib equal to 4 and set Fill to 1's. c. Press the right half of the **SETUP SELECT** switch.

Step:	Activity:
5. (Cont.)	d. Set 8M→34M TxTrib equal to 1 and set Fill to 1's. e. Press the right half of the **SETUP SELECT** switch. f. Set 34M→140M TxTrib equal to 2 and set Fill to 1's. g. Press the right half of the **SETUP SELECT** switch to return to the HOME menu.
6.	Set the **SETUP CATEGORY** switch to AUXILIARY.
7.	Press the **SETUP SELECT** switch to display the Performance menu.
8.	Press the softkey below the In-Serv menu item to select M.550 in-service performance analysis.
9.	Set the **RECEIVE INPUT** switch to MON.

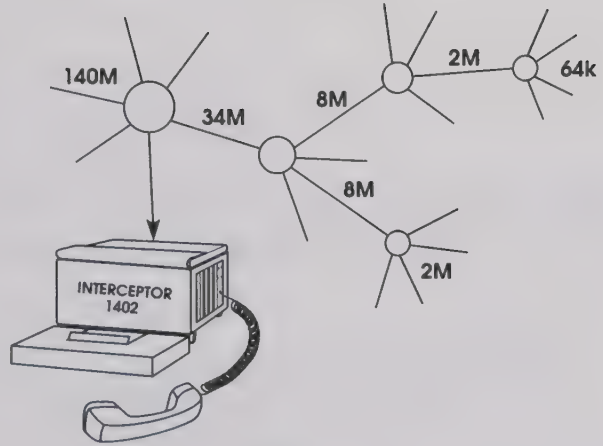

Figure 2-1
In-Service Analysis

Step:	Activity:
10.	Using the appropriate cables, connect the INTERCEPTOR 1402 to the equipment under test. Since the RECEIVE INPUT is set to MON, be sure that the INTERCEPTOR is connected to a monitor point with between 20 and 30 dB of resistive loss. Note that the connectors for the 140M option are on the right side of the INTERCEPTOR.
11.	Press the **RESTART** switch to begin the test.
12.	If a hardcopy of the test results is desired, press the **RESULTS** switch to generate a results printout. Customize status, error, and timed print events using the AUXILIARY CATEGORY. To enable these automatic printouts, set the **PRINTER ON/OFF** switch to ON.

2.1.2 Point-To-Point Testing

Point-to-point testing with the INTERCEPTOR 1402 verifies that the data received at one point is the exact data transmitted at another point. The INTERCEPTOR can test a single tributary from any access point, to isolate circuit sections and pinpoint problem sections. To do this, both units are connected the same. Figure 2-2 shows two INTERCEPTORs testing for bit and code errors, framing, frequency, and pattern slip measurements between two points in both directions simultaneously. The following procedure provides step-by-step instructions for performing this test with both INTERCEPTORs set the same.

Step:	Activity:
1.	Turn the power switch ON.
2.	Press the **TEST MODE** switch to select the desired data rate.
3.	Set the **SETUP CATEGORY** switch to select the MODE category.
4.	Use the **SETUP SELECT** switch (note that this switch is backlit when RECALL/STORE, PATTERN, TIMING, MODE, and AUXILIARY CATEGORY switches are selected) located above the **SETUP SELECT** switch and the softkeys below the SETUP display, to configure the MODE menu as follows: A. Select Framed or Unframed. B. Press the right half of the **SETUP SELECT** switch. C. Set Coding to HDB3, AMI, RZ, NRZ, or CMI (140M - note the connector is on the right side). D. Press the right half of the **SETUP** switch. E. If receiving at 2M Framed, set TS16 and CRC4 On or Off. F. Press the right half of the **SETUP SELECT** switch.

Step:	Activity:
4. (Cont.)	G. Set 2M I/O Format to 75Ω or 120Ω (if receiving at 2M). H. Press the right half of the **SETUP SELECT** switch. I. Set the International bit in 2M FAS to either 1 or 0 (only displayed if CRC4 is set Off). J. Press the right half of the **SETUP SELECT** switch. K. Set the 5 least significant bits of the 2M NFAS to 1 or 0 (the default is 11a11111). L. Press the right half of the **SETUP SELECT** switch. M. Set the Tx alarm status On or Off. N. Press the right half of the **SETUP SELECT** switch to return to the HOME menu.
5.	Use the **SETUP CATEGORY** switch to select the TIMING category.
6.	Using the softkeys below the SETUP display, set the TIMING menu to **Int**, **Rec**, or **Ext**. Note that if both INTERCEPTORs are using REC TIMING, there must be a timing source in the network. If **Ext** is selected, there must be a clock provided on the BNC connector labeled EXT CLK IN.
7.	Set the **SETUP CATEGORY** switch to PATTERN.

Step:	Activity:
8.	Using the MORE softkey and the corresponding softkey below the SETUP display, select the desired data pattern.
9.	Set the **RECEIVE INPUT** switch to TERM.
10.	Set the **OUTPUT LEVEL** switch to the desired level (0dB, -6dB, or -12dB).
11.	Using the appropriate cables, connect the INTERCEPTOR 1402 to the equipment under test. For 140M mode, the I/O connectors are located on the right side of the INTERCEPTOR unit.
12.	Press the **RESTART** switch to begin the test.
13.	Verify that: • The SIGNAL PRESENT green LED is illuminated. • The appropriate FAS SYNC green LED is illuminated if framing is selected. • PATTERN SYNC green LED is illuminated.

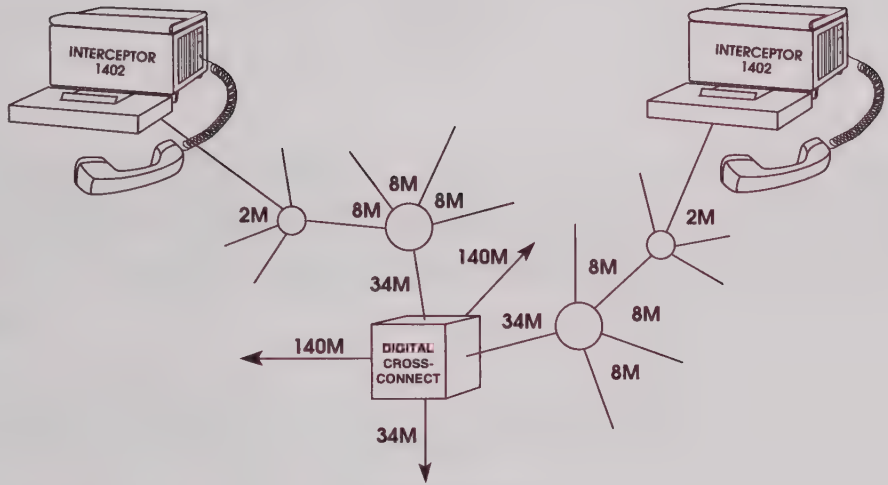

Figure 2-2
Point-to-Point Testing

Step:	Activity:
14.	Set the ANALYSIS RESULTS CATEGORY switch to SUMMARY and verify the results.
15.	If a hardcopy of the test results is desired, set the **PRINTER ON/OFF** switch to ON and press the **RESULTS** switch. Status, error, and timed print events can be customized using the AUXILIARY CATEGORY.

2.1.3 Testing Multiplexers

Multiplexer testing with the INTERCEPTOR 1402 enables sections of the network to be isolated for testing. Only the tributaries under test are removed from service. Figure 2-3 depicts the equipment connection for multiplexer testing. The INTERCEPTOR generates test data and analyzes the received data for errors and is able to obtain information on the multiplexing equipment, bit errors, G.821 analysis, framing and frequency. The following procedure is detailed instructions for performing this test with the INTERCEPTOR. Note that the following procedure requires the 140M and Nx64K options.

Step:	Activity:
1.	Turn the power switch ON.
2.	Press the **TEST MODE** switch to select MUX TEST.
3.	Press the **SETUP CATEGORY** switch to select the MODE category.
4.	Use the **SETUP SELECT** switch and the softkeys below the SETUP display to configure the MODE menu as follows: **Select:** A. Set Input equal to 140M. B. Set Analysis Result equal to Nx64. C. Set Output equal to 34M. D. Press the ENTER key. E. Press the right half of the **SETUP SELECT** switch. F. Set 140M Coding to CMI or NRZ. If Input is other than 140M, the Coding choices are: HDB3, AMI, RZ, or NRZ. G. Press the right half of the **SETUP SELECT** switch.

Step:	Activity:
4. (Cont.)	H. Set the Tx Alarms as desired. I. Press the right half of the **SETUP SELECT** switch. J. Set 140M→34M RxTrib equal to 1, 2, 3, or 4. K. Press the right half of the **SETUP SELECT** switch. L. Set 34M→8M RxTrib equal to 1, 2, 3, or 4. M. Press the right half of the **SETUP SELECT** switch. N. Set 8M→2M RxTrib equal to 1, 2, 3, or 4. O. Press the right half of the **SETUP SELECT** switch. P. Set TS16 and CRC4 On or Off. Q. Press the right half of the **SETUP SELECT** switch. R. Set the International bit in 2M FAS to 1 or 0. S. Press the right half of the **SETUP SELECT** switch. T. Set the 2M NFAS bits to 1 or 0. Press the ENTER softkey after changing any bit value. U. Press the right half of the **SETUP SELECT** switch. V. Set the Analysis mode to Nx64. W. Press the right half of the **SETUP SELECT** switch.

Step:	Activity:
4. (Cont.)	X. Set the Rx/Tx TS Coupling to On. Y. Press the right half of the **SETUP SELECT** switch. Z. Set the 1stTS as desired. Press the **MORE** switch and set Fill to 1's. a. Press the right half of the **SETUP SELECT** switch. b. Set the 2M→8M TxTrib equal to 1, 2, 3, or 4 and set the Fill pattern to 1's or Rnd. c. Press the right half of the **SETUP SELECT** switch. d. Set 8M→34M TxTrib equal to 1, 2, 3, or 4 and set the Fill pattern to 1's or Rnd. e. Press the right half of the **SETUP SELECT** switch. f. Press the right half of the **SETUP SELECT** switch to return to the HOME menu.
5.	Set the **SETUP CATEGORY** switch to TIMING.
6.	Using the softkeys below the SETUP display, set the TIMING menu to **Int**.
7.	Set the **SETUP CATEGORY** switch to PATTERN.

Step:	Activity:
8.	Using the **MORE** key and the appropriate softkey below the SETUP display, select the desired data pattern.
9.	Set the **RECEIVE INPUT** switch to MON (BRIDGE is not available for 140M).
10.	Set the **OUTPUT LEVEL** to the desired level (0dB, -6dB, or -12dB). Note that if 140M is selected for the output rate, only 0dB is available for this selection.
11.	Using the appropriate cables, connect the INTERCEPTOR 1402 to the equipment under test. Keep in mind that the connectors for the 140M option are on the side of the unit.
12.	Press the **RESTART** switch to begin the test.
13.	Verify that: • The SIGNAL PRESENT green LED is illuminated. • The 34M and 8M FAS SYNC green LEDs are illuminated. • The 2M FAS SYNC green LED is illuminated, if 2M framing is selected. • The PATTERN SYNC green LED is illuminated.

Step:	Activity:
14.	Set the ANALYSIS RESULTS CATEGORY switch to SUMMARY. Verify the results.
15.	If a hardcopy of the test results is desired, set the **PRINTER ON/OFF** switch to ON and press the **RESULTS** switch. Status, error, and timed print events can be customized using the AUXILIARY CATEGORY.

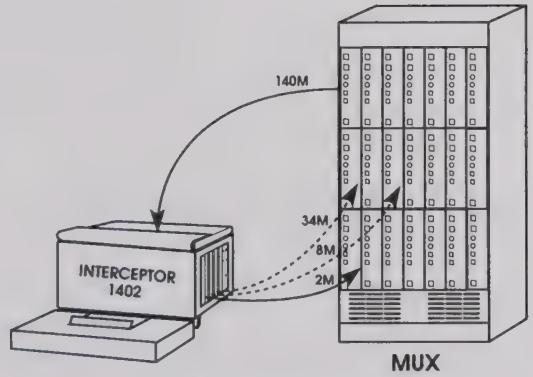

Figure 2-3
Testing More Than One Multiplexer

2.1.4 Testing Two Demultiplexers

Demultiplexer testing with the INTERCEPTOR 1402 enables isolation of a problem in a single direction, and tests the demultiplexing capabilities of two multiplexers. Figure 2-4 depicts an INTERCEPTOR 1402 testing a 34 Mb/s MUX and a 8 Mb/s MUX to obtain information on bit errors, G.821 analysis, framing, frequency, and pattern slips. The following procedure provides step-by-step instructions for performing this test with the INTERCEPTOR 1402.

Step:	Activity:
1.	Turn the power switch ON.
2.	Set the **TEST MODE** switch to MUX TEST.
3.	Set the **SETUP CATEGORY** switch to MODE.
4.	Using the **SETUP SELECT** switch and the softkeys below the SETUP display, configure the MODE menu as follows:

Step:	Activity:
4. (Cont.)	**Select:** A. Set the Input equal to 2M. B. Set the Analysis Rate equal to 2M. C. Set the Output equal to 34M. D. Press the ENTER key. E. Press the right half of the **SETUP SELECT** switch. F. Set the Coding to HDB3, AMI, RZ, or NRZ. G. Press the right half of the **SETUP SELECT** switch. H. Select 2M Framed or Unframed. I. Press the right half of the **SETUP SELECT** switch. J. If testing at 2M Framed, set TS16 and CRC4 On or Off. K. Press the right half of the **SETUP SELECT** switch. L. Set 2M→8M TxTrib to 1, 2, 3, 4, or All. If the tributary is specified as 1, 2, 3, or 4, set the Fill pattern to Rnd or 1's. M. Set 8M→34M TxTrib equal to 1, 2, 3, 4, or All. If the tributary is specified as 1, 2, 3, or 4, set the Fill pattern to Rnd or 1's. N. Press the right half of the **SETUP SELECT** switch to return to the HOME menu.

Step:	Activity:
5.	Set the **SETUP CATEGORY** switch to TIMING.
6.	Use the softkeys below the SETUP display to set TIMING to **Int**.
7.	Set the **SETUP CATEGORY** switch to PATTERN.
8.	Use the **MORE** key and the appropriate softkey below the SETUP display, select the desired data pattern.
9.	Set the **RECEIVE INPUT** switch to TERM.
10.	Set the **OUTPUT LEVEL** to the desired level (0dB, -6dB, or -12dB).
11.	Using the appropriate cables, connect the INTERCEPTOR 1402 to the equipment under test. Keep in mind that the connectors for the 140M mode are on the right side of the unit.
12.	Press the **RESTART** switch to begin the test.

Step:	Activity:
13.	Verify that: • SIGNAL PRESENT green LED is illuminated. • 2M FAS SYNC green LED is illuminated if framing is selected. • PATTERN SYNC green LED is illuminated.
14.	Set the ANALYSIS RESULTS CATEGORY switch to SUMMARY. Verify the results.
15.	If a hardcopy of the test results is desired, set the **PRINTER ON/OFF** switch to ON and press the **RESULTS** switch. Both the error and time print events can be customized using the AUXILIARY CATEGORY.

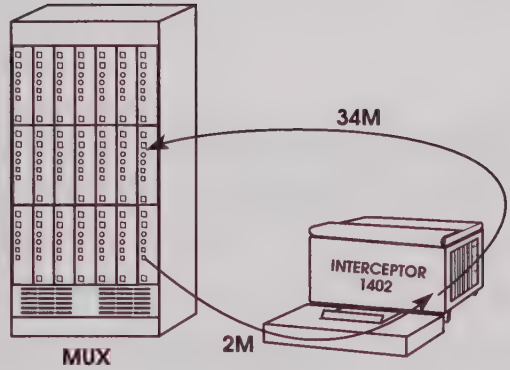

Figure 2-4
Demultiplexer Testing

2.2 CONFIGURING THE INTERCEPTOR 1402 WITH THE PR-55 PRINTER

This section describes how the INTERCEPTOR 1402 can be configured with the PR-55.

Encased in the lid of the INTERCEPTOR 1402, the PR-55 printer is a thermal printer that provides 40-column printouts of test results. Although any serial ASCII printer can be used with the INTERCEPTOR 1402, the PR-55 is highly recommended for its convenience and ease of use.

The following provides step-by-step instructions to configure the INTERCEPTOR 1402 for operation with the PR-55 printer.

Step:	Activity:
1.	With the power to the INTERCEPTOR 1402 turned OFF, plug the PR-55 connector into the INTERCEPTOR 1402 front panel connector labeled PRINTER (located below the **SELF LOOP** switch).
2.	Turn the power switch ON.
3.	Set the **CATEGORY** switch to the AUXILIARY position.

Step:	Activity:
4.	Use the **SETUP SELECT** switch to scroll to the RS232 auxiliary function. **Select:** A. Press the MORE key. B. Press the PR55 softkey to automatically configure the baud rate, data bits, and parity (9600, 8, and None, respectively). **NOTE:** PR55 is the 1402 factory-default setting for the printer configuration.
5.	Press the right half of the **SETUP SELECT** switch once to scroll to the Printer auxiliary function. **Select:** A. Set Width to 40. B. Set Term (line termination) to CRLF (carriage return/linefeed).
6.	If not illuminated, press the **ON LINE** switch on the PR-55 printer to illuminate the green LED within the switch. The INTERCEPTOR 1402 is now configured for operation with the PR-55 printer.

2.2.1 Serial Printer Connector

When using a printer other than the PR-55, it connects to the 25-pin, RS-232 printer/controller interface connector, located on the side panel. Table 2-1 lists the RS-232 printer/connector interface connector pin assignments.

Table 2-1
RS-232 Printer/Connector Interface Connector Pin Assignments

Pin No.	Designation EIA/CCITT	Signal Description	Status
1	AA ——	Protective Ground	Connected to chassis ground.
2	BA 103	Transmitted Data (TD)	Data transmitted to the INTERCEPTOR (from the printer).
3	BB 104	Receive Data (RD)	Data received from the INTERCEPTOR (to the printer).
5	CB 106	Clear to Send (CTS)	Output HIGH when the INTERCEPTOR is ready to receive.
6	CC 107	Data Set Ready (DSR)	Output HIGH when the INTERCEPTOR power is on.
7	AB 102	Signal Ground	Connected to signal ground.
8	CF 109	Received Line Signal Detector (RLSD)	Output HIGH when the INTERCEPTOR power is on.
20	CD 108/2	Data Terminal Ready (DTR)	Input must be HIGH before the INTERCEPTOR can send data.

Data is communicated across the RS-232 connector in asynchronous, serial format, using standard ASCII (American Standard Code for Information Interchange) format characters. The printer interface can operate at baud rates of: 300, 1200, 2400, 4800, or 9600. The INTERCEPTOR sends two stop bits, and expects received data to have one or more stop bits.

This connector is wired in parallel with the front panel PRINTER connector. Therefore, only connect one printer at a time to the INTERCEPTOR. Connecting two printers at a time can cause partial printouts to be generated.

Use the Printer and Data Format auxiliary menus to select the number of data bits, parity, and line termination. These two auxiliary menus determine the data format for data transferred across the interface.

2.2.2 Parallel Printer Connector

With the IEEE-488 option installed, a parallel printer or controller can be used with the INTERCEPTOR. The 24-contact, IEEE-488 connector is located on the INTERCEPTOR side panel. This connector can support operation of a parallel printer or remote control device. Printer and remote control selection is determined by the PRINT auxiliary menu selection. Repeatedly pressing the softkey below the **Select** menu item scrolls through the menu selections. Selecting 488 for the printer driver sets the INTERCEPTOR in the talk-only mode. This configures the INTERCEPTOR to send all printer information to the IEEE-488 connector and does not respond to any IEEE-488 remote commands. However, setting RC (remote control) to **488** places the INTERCEPTOR in the addressable mode. The INTERCEPTOR address is indicated and controlled from the IEEE-488 Address auxiliary menu. The current 488 address (00 to 31) is indicated on the top line and is controlled by the softkey below the Up or Down menu items on the bottom line of the menu. Please refer to the *INTERCEPTOR 1402 Reference Manual* for additional IEEE-488 remote control information.

The IEEE-488 connector supports either a parallel printer or remote controller, but not both simultaneously. Table 2-2 lists the IEEE-488 connector contact assignments.

Table 2-2
IEEE-488 Printer/Controller Interface Connector Contact Assignments

Contact No.	Signal Line	Contact No.	Signal Line
1	DIO1	13	DIO5
2	DIO2	14	DIO6
3	DIO3	15	DIO7
4	DIO4	16	DIO8
5	EOI	17	REN
6	DAV	18	Gnd for pin 6
7	NRFD	19	Gnd for pin 7
8	NDAC	20	Gnd for pin 8
9	IFC	21	Gnd for pin 9
10	SRQ	22	Gnd for pin 10
11	ATN	23	Gnd for pin 11
12	Shield	24	Gnd, Logic

AUXILIARY FUNCTIONS

Function	Name	Description
Monitor Gain	Mon Gain	Selects compensation to allow for different combinations of cable and resistive monitor points.
Logic Error Insert	Logic Err Insert	Rate - Sets the logic error insertion rate.
Frame Error Insert	Frame Err Insert	Rate - Sets the frame error insertion rate.
Adjacent FAS Error Insert	Adjacent FAS Err	#Err - Sets the number of frame errors inserted in consecutive frames.
Code Error Insert	Code Err Insert	Rate - Sets the code error insertion rate.
Printer/Controller Selection	Print	Selects which ports are used for printing and remote control: RS232, IEEE488, or None.

AUXILIARY FUNCTIONS (Continued)

Function	Name	Description
RS-232 Printer/Controller Interface	RS232	Configures the RS-232 printer/controller interface port. Baud - Sets the RS-232 connector baud rate (300, 1200, 2400, 4800, or 9600). Data - Sets character length (7 or 8). Parity - Sets parity (None, Even, or Odd). PR55 - Automatically sets baud rate (9600), character length (8), and parity (None) for the lid printer. PR40A - Automatically sets baud rate (2400), character length (8), and parity (None) for the PR-40A printer.

AUXILIARY FUNCTIONS (Continued)

Function	Name	Description
IEEE-488 Address	IEEE 488	Selects the IEEE-488 address.
Printout Format	Printer	Selects the format for printouts. Width- Selects the line width of the printout (40 or 80 characters wide). Term- Selects line termination: CR (carriage return), LF (linefeed), or CRLF (carriage return/linefeed).
Results Print Content Selection	Result Print	Controls the content of Analysis Results printouts. Sum - Lists all non-zero results, the number of bit errors, code errors, CRC errors, frame alignment signal errors, pattern slips, synchronization loss, and any active or history alarms. Std - Lists all results that apply to the selected rates.

AUXILIARY FUNCTIONS (Continued)

Function	Name	Description
Results Print Content Selection (Continued)	Result Print	Short - Lists a selection of performance-related results. Long - Lists all results that apply to the selected rates.
Timed Printout Occurrence	Timed Print	Sets the time HH:MM, at which an automatic timed print occurs or sets automated print to Off.
Error Print Selection	Error Print	Selects which errors generate an AUTO print: Bit, Code, FAS, CRC, Pattern Slip, Pre-Pwr Loss, and SES.
Status Print Selection	Status Print	Selects which alarm generates an AUTO print: Signal Present, Signal Loss, Pattern Sync Acquired, Pattern Sync Loss, FAS Sync Acquired, FAS Sync Loss, Power Up, Alarm Transition, Performance Transition, and Frequency Drift.

AUXILIARY FUNCTIONS (Continued)

Function	Name	Description
Print Storage Use	Memory Store	Selects whether Memory Prints or Histogram Storage is enabled. Note only one of these at a time can be enabled.
Memory Print	Mem Print	Controls the operation of memory print. Print - generates a printout of the stored printouts. Clear - clears all printouts from the print buffer. On/Off - sets the memory print capability On or Off.
Histogram Buffer	Hist Buffer	Selects whether Histogram Buffer is ON (storing data), OFF (not recording) or CLEAR (empty the buffer). This function also shows the percentage of the memory buffer that is stored.

AUXILIARY FUNCTIONS (Continued)

Function	Name	Description
Histogram Type	Type	Selects the type of Histogram Print, GRAPH (uses graphics mode of printer), TEXT (uses ASCII), or LIST (prints out a complete list of histogram values for computer interpretation).
Histogram Start	Hist Start	Selects the start time (format for Time to begin is DD/HH:MM) for a histogram, relative to turning on the buffer.
Histogram Length	Hist Length	Selects the length of time (formatted DD/HH:MM), relative to the time the buffer is turned on, for the test being histogrammed.
Histogram Result	Hist Result	Selects which result is to be histogrammed.
Patt Slip Detect	Resync on Pattern Slip	Determines whether or not a pattern slip causes a pattern sync loss.

AUXILIARY FUNCTIONS (Continued)

Function	Name	Description
Performance	Performance	Selects the type of error performance analysis: G.821, M.550, or Custom M.550 errors.
Custom M.550 Anomaly Selection	Anomaly	Selects whether Bit, Code, FAS, CRC, or AIS errors need to be included in Anomaly calculation.
Anomaly	Anomaly: All On	Measures Bit Errors, Code Errors, and Error Seconds (M.550).
Custom M.550 Defect Selection	Defects	Selects the appropriate events (Pat Sync Loss, Sig Loss, FAS Loss, Alarms) that should be counted as Defects.
Custom M.550 SES Calculation	SES	Determines the number of Code, FAS, and CRC errors that should be seen per second, to obtain a severely errored second (SES).

AUXILIARY FUNCTIONS (Continued)

Function	Name	Description
Panel Lock	Lock front panel	Locks the set-up portion of the front panel. To unlock the front panel, hold down the ENTER key for 3 seconds.
Site Identification	Site ID	Assigns a specific alphanumeric identifier of 8 characters or less to the site under test.
Re-Start on Power Up	Restart on PwrUp	Resumes test which was interrupted at a power outage, and preserves the results of the interrupted test.
Date	Date	Sets the current date in day (1-31), month (Jan-Dec), and year (00-99) order.
Time	Time	Sets the current time in hours (00-23), minutes (00-59), and seconds (00-59).

AUXILIARY FUNCTIONS (Continued)

Function	Name	Description
Clear Non-volatile Memory	Clear Memory?	Returns all configurations to their factory-default settings.
Language Selection	Language	Selects the language in which the information and results are displayed; Englsh (English) and Frçais (French) are available.

GLOSSARY OF ANALYSIS RESULTS

%Avl Sec (% Available Seconds) G.821	The ratio, expressed as a percentage, of the number of available seconds to the number of test seconds.
%Av T (% Available Time) M.550	The ratio of available time to test seconds, this applies to G.821 and M.550, all rates.
%Deg Min (% Degraded Minutes) G.821/M.550	The ratio, expressed as a percentage, of the number of degraded minutes to the number of minutes made up from available, non-severely errored seconds.
%EFS (% Error-Free Seconds) G.821/M.550	The ratio of error free seconds to available time, for all rates.
%SES (% Severely Errored Seconds) G.821/M.550	The ratio of severely errored seconds to available time, for all rates.
AIS (Alarm Indication Signal)	Occurs when an unframed all ones signal has been detected. This occurs at all rates.
8Remote	Occurs when bit 11 of the 848 bit frame is set to 1.
34Remote	Occurs when bit 11 of the 1536 bit frame is set to 1.

GLOSSARY OF ANALYSIS RESULTS (Continued)

140Remote	Occurs when bit 13 of the 2928 bit frame is set to 1.
1Sec CRC (One-Second CRC Error)	The number of CRC errors received over the last one-second test interval.
ABCD (ABCD Signalling bits)	The Channel Associated Multiframe Signal bits for the Rx timeslot.
Avl Sec (Available Seconds) G.821	The number of seconds judged available by CCITT Recommendation G.821 criteria.
Av T (Available Time) M.550	The number of seconds judged available by CCITT Recommendation M.550 criteria, at all rates.
BER (Bit Error Rate)	The ratio of the number of bit errors counted to the number of data bits examined since pattern sync was obtained, for Analysis rate only.
BER-SES (Bit Error Rate Excluding Severely Errored Seconds) G.821	The bit error ratio excluding bits that occurred during severely errored seconds.

GLOSSARY OF ANALYSIS RESULTS (Continued)

Bit Errs (Bit Errors)	The number of errored data bits received since pattern sync was obtained, Analysis rate only.
CER (Code Error Rate)	The ratio of the number of code errors counted to the number of bits examined since the beginning of the test.
Code (Code Errors)	The number of code errors detected.
CRC Err (CRC Error)	The number of CRC errors counted since the beginning of the test.
CRC E Rt (CRC Error Rate)	The ratio of the number CRC errors counted to the total number of CRCs counted.
CRC FSL (CRC FAS Sync Losses)	2M FAS Sync Losses (when CRC4 is enabled).
Date (Date)	The calendar date given in day, month, and year. The time of day and date may be set through the Time and Date Auxiliary functions, respectively.

GLOSSARY OF ANALYSIS RESULTS (Continued)

Def S (Defect Seconds) M.550	The total number of available seconds in which a defect was detected, this occurs at all rates.
Deg Min (Degraded Minutes) M.550/G.821	The number of blocks of 60 non-severely errored available seconds in which the average BER over the 60 seconds was worse than 10^{-6}.
EFS (Error-Free Seconds) G.821	The number of available seconds during which no bit errors were detected.
EFS (Error-Free Seconds) M.550	The total number of available seconds without an anomaly or a defect.
Elap Sec (Elapsed Seconds)	The number of seconds since the beginning of the test.
Err Sec (Errored Seconds) G.821	The number of available seconds in which at least one bit error occurred.
Err-SES (Bit Errors-Severely Errored Seconds)	The number of bit errors, excluding errors that occurred during severely errored seconds.
ES (Errored Seconds) M.550	The total number of available seconds with a defect or anomaly, this occurs at all rates.

GLOSSARY OF ANALYSIS RESULTS (Continued)

FAS (Frame Alignment Signal errors)	The number of FAS errors detected. This number can be based on FAS bit errors or FAS word errors depending on the auxiliary function "FAS bit/word results."
FAS Wd (Frame Alignment Signal Word)	Displays the frame alignment signal word, in binary, with the errored bit within the word displayed as an X. The word size is rate dependent.
FAS Dis (Frame Alignment Signal Distant or 2M Remote Alarm)	Occurs when bit 3 of "not the frame word" is set to 1 in a 2M signal.
FER (Frame Alignment Signal Error Rate)	The ratio of the number of frame alignment signal errors over the number of frame alignment signals received since initial frame sync. This result can be based on FAS bit errors or FAS word errors depending on the auxiliary function "FAS bit/word results."
FSL (FAS Sync Losses)	The number of times FAS sync was lost, available for all rates.
MFAS Dis (Multiframe Alignment Signal Distant or Timeslot 16 Remote Alarm)	Occurs when bit 6 in timeslot 16 in frame zero is set to 1 in a 2M signal.

GLOSSARY OF ANALYSIS RESULTS (Continued)

MFAS Err (Multiframe Alignment Signal Error)	Occurs when 1 or more bits in the MFAS is errored.
MFAS Wd (Multiframe Alignment Signal Word)	Displays the 8 bits comprising the MFAS word. An "x" indicates an errored bit.
MFSL (Multiframe Sync Losses)	The number of times MFAS sync was lost, occurs in Print mode only.
MFER (Multiframe Error Rate)	The number of errored multiframes divided by the number of multiframes.
MRER (Mean Residual Error Rate) M.550	The error rate for all non-severely errored seconds that are in available time.
NFAS Wd (2M Not Frame Alignment Signal)	Displays the odd 2M frame alignment signal in binary.
Pat Loss (Pattern Sync Losses)	Number of occurrences Pattern Sync was lost.
Pat Slip (Pattern Slips)	The number of occurrences since the beginning of the test where data bits have been added to or deleted from the received pattern.

GLOSSARY OF ANALYSIS RESULTS (Continued)

Pwr Loss (Power Losses)	The number of power failures encountered during the current test.
Rx Freq (Receiver Frequency per Rate)	The frequency measurement on the receiver clock.
Rx Δppm (Receiver Frequency Deviation per rate)	The maximum received frequency deviation measured in ppm (parts per million) since the beginning of the test.
SES (Severely Errored Seconds) G.821	The number of seconds during which the BER is worse than 10^{-3}.
SES (Severely Errored Seconds) M.550	The number of seconds in which defects were detected or anomaly thresholds were exceeded, available for all rates.
Sig Loss (Signal Losses)	The number of times the input signal was lost.
Slip Sec (Seconds with Pattern Slips)	The number of seconds during which pattern slips were detected.
Syn Loss (Pattern Sync Loss)	The number of sync losses since the beginning of the test, available for Print mode only.

GLOSSARY OF ANALYSIS RESULTS (Continued)

Test Sec (Test Seconds) G.821	The number of seconds counted after initial pattern synchronization is achieved.
Test Sec (Test Seconds) M.550	The number of seconds counted after initial signal presence is detected.
Time (Time)	The time of day in hours, minutes, and seconds. Hours are given in a 24-hour format.
TS16 AIS (Time Slot 16 Alarm Indication Signal)	Occurs when there are all ones in timeslot 16.
Tx Freq (Transmit Frequency per Rate)	The frequency measurement made on the generator clock.
Una Sec (Unavailable Seconds) G.821	The number of seconds judged unavailable by CCITT Recommendation G.821 criteria.
Una T (Unavailable Time) M.550	The number of seconds judged unavailable by CCITT Recommendation M.550 criteria available for all rates.

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